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A Rare Case Report of End Stage Occupational Lung Disease- A Single-Centre Experience From South India

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Abstract

Byssinosis, also known as "brown lung disease," is a respiratory condition caused by prolonged inhalation of cotton, flax, and other textile fibers. It predominantly affects workers in India's textile industry. Classified as hypersensitivity pneumonitis (HP), byssinosis manifests symptoms such as chest tightness, cough, and wheezing, particularly on Mondays. While its exact pathogenesis remains unclear, it shares similarities with HP. Although byssinosis can lead to chronic lung diseases, fibrosis is rare, Byssinosis is primarily linked to cotton dust exposure, with prolonged exposure (20-30 years) posing a significant risk [1]. Studies emphasize the importance of preventive measures, such as dust reduction, protective equipment, and rotating workers to minimize exposure. Factors like endotoxin exposure and smoking further affect lung function over time. Effective management of occupational exposure and awareness is crucial for improving byssinosis outcomes. Here we present a case of a female patient for whom, due to progressive fibrosis and respiratory failure, lung transplantation was recommended following multidisciplinary discussions [2].

Keywords: Byssinosis, Interstitial lung disease, cotton, Hypersensitive pneumonitis, Lung transplant

Introduction

Globally, India ranks as the second-largest producer of textile products, contributing 20% to the country's industrial output. Approximately 20 million workers are employed across 1,175 cotton mills in India, making the textile sector a major occupational group. Byssinosis is also seen in countries like USA and England but its prevalence in developing countries is notable [3]. For instance, Turkey reported a prevalence of 14.2% within the past decade. Studies on byssinosis among Indian cotton textile workers are limited. In one key study, Murlidhar et al. examined 273 workers in Mumbai, finding that 30% of those in dusty environments and 17%

of those in non-dusty sections had byssinosis. Additionally, they developed a questionnaire for the assessment of the condition. Despite India's prominent textile industry, comprehensive research on the magnitude and risk factors for byssinosis remains scarce.

Case Report

A 40-year-old female, who has been successfully managing a textile business for the past 15 years, presented to our outpatient department with a primary complaint of progressively worsening breathlessness and a persistent cough. The symptoms had been gradually increasing over time, leading to significant difficulty in carrying out daily activities. She did not report any other significant medical history, comorbidities, or recent infections, but her occupational exposure as a textile business owner was noted as a potential risk factor. On physical examination, fine late inspiratory crackles (crepitations) were detected on auscultation, predominantly at the lung bases. These findings were suggestive of an underlying pulmonary pathology, raising suspicion for interstitial lung disease (ILD) or fibrosis. Further investigations were initiated, starting with HRCT scan of the chest. The HRCT revealed ground glass opacities, fibrosis, and a triple-density pattern, all of which are characteristic of ILD. The appearance of ground-glass opacities suggested active inflammation, while the fibrosis and triple-density pattern indicated ongoing structural damage to the lungs. Pulmonary function tests (PFTs) were performed, which demonstrated a restrictive pattern, consistent with reduced lung volumes typically seen in patients with ILD or other fibrotic lung diseases. The patient's DLCO (diffusing capacity for carbon monoxide), a marker of the lungs' ability to exchange gases, was significantly reduced, reflecting impaired gas exchange due to the fibrotic changes in the lung tissue. A series of 6-minute walk tests were also conducted, which showed oxygen desaturation with exertion, further underscoring the severity of her lung impairment. Given the progressive nature of her symptoms, her deteriorating lung function, and the findings from imaging and functional studies, the patient was placed under close monitoring and multidisciplinary care, including pulmonology, respiratory therapy, and occupational health specialists. Despite optimal medical management and regular follow-ups, her condition continued to decline. After discussion with patient and the family, the decision was taken to list her for lung transplantation. Given the extent of her disease and poor response to conventional treatments, she was deemed a suitable candidate for a lung transplant, and plans for the procedure were initiated. The transplant was considered the best therapeutic option to improve her quality of life and long-term prognosis.

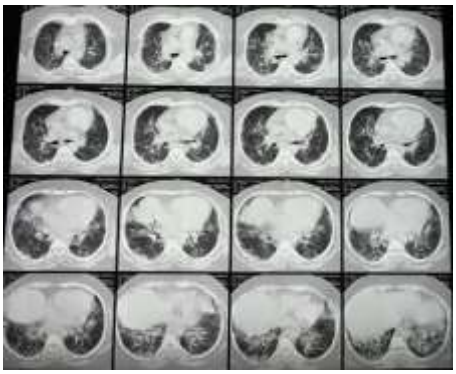

Figure 1: CT Thorax showing; Ground glass opacities, Triple density and early fibrosis features

Figure 2: CT Thorax showing progressive fibrosis, Honey combing

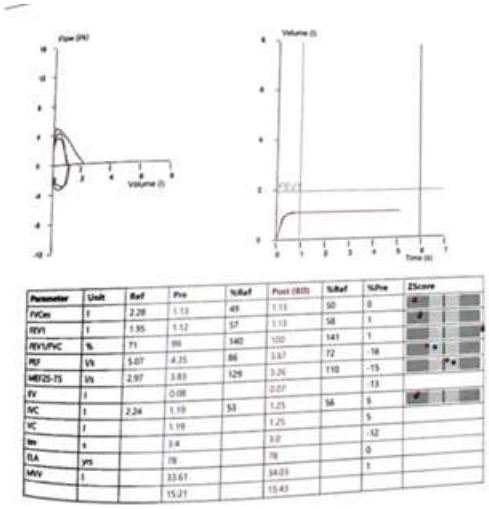

Figure 3: Spirometry showing severe restriction

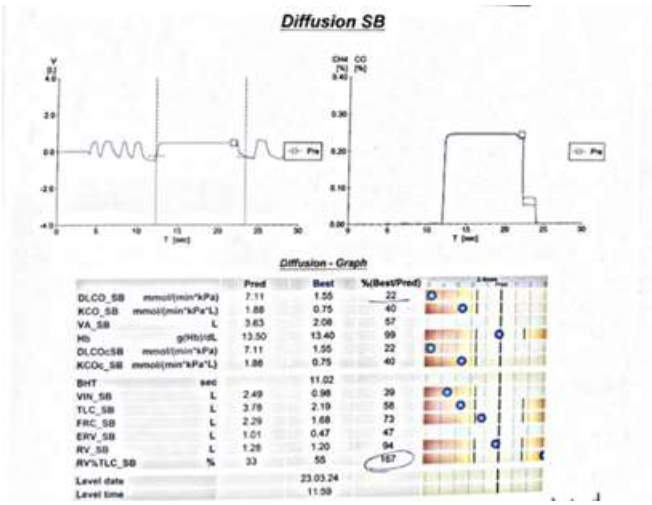

Figure 4: DLCO showing Decreased diffusion capacity

Discussion

Exposure to cotton dust in manufacturing environments is well-documented to cause respiratory issues, with byssinosis being a notable condition affecting workers processing cotton, flax, and hemp fibers. While byssinosis is often characterized by symptoms such as cough, wheezing, and "Monday morning fever," recent observations suggest that some individuals exposed to cotton dust may develop alternative respiratory conditions without these classical symptoms [1]. In a review of existing research, there have been incidence of ILD especially HP and pneumoconiosis caused because of exposure to organic dust. Pneumoconiosis causes A post-mortem study has also suggested a link between cotton fibers and pulmonary fibrosis in humans. In these cases, fibrosis tends to develop around cotton fibers inhaled into the lungs, leading to peribronchiolar fibrosis and granulomatous reactions [2]. Recent studies on textile workers have shown a significant prevalence of respiratory symptoms, with more than half of surveyed workers reporting at least one symptom, and over 40% experiencing shortness of breath. The duration of occupational exposure in textile industries were closely associated with the onset of these symptoms, with underlying obstructive airway disease. Obstructive airway diseases such as asthma and copd and chronic byssinosis which developed due to long standing exposure to cotton dust Chronic exposure to cotton dust [3]. This lower prevalence may reflect improvements in dust control measures in textile mills, particularly in high-income countries, where modernization of machinery and ventilation systems have reduced dust levels. Comparisons across studies indicate that mills with better dust control report lower incidences of byssinosis and related respiratory conditions.

Several challenges have been identified in accurately assessing the prevalence of byssinosis in contemporary textile workers, particularly in developing countries [4]. These include difficulties in understanding complex, symptom-based screening questions and variations in diagnostic criteria. Simplified assessment methods, focusing on symptoms aggravating during work, may improve the identification of byssinosis in epidemiological surveys. Additionally, smoking has been identified as a significant factor contributing to respiratory symptoms among workers, though no clear trend was observed in relation to different types of textile mills. Spinners, however, showed a higher likelihood of abnormal spirometry outcomes [5]. In conclusion, the

evidence suggests that organic dust, including cotton dust, can lead to pneumoconiosis and other respiratory disorders. The development of pulmonary fibrosis in individuals exposed to cotton fibers underscores the need for improved dust control and protective measures in textile manufacturing environments. Moreover, further research is needed to refine diagnostic criteria and enhance early detection of respiratory conditions in workers exposed to organic dust.

Conclusion

Byssinosis, a type of interstitial lung disease (ILD) that is caused by inhaling cotton dust in inadequately ventilated working environments. Although it is rare, it is possible for byssinosis to lead to fibrosis, a condition where lung tissue becomes scarred and stiff. This scarring can make it difficult for the lungs to function properly and can ultimately lead to severe respiratory issues. In this case, we present a rare instance where byssinosis progressed to fibrosis and ultimately required a lung transplantation. The patient, who had been exposed to cotton dust for an extended period, began to experience symptoms such as chest tightness, coughing, and shortness of breath. Despite initial treatments, the condition worsened, leading to the development of fibrosis. The progression of byssinosis to fibrosis in this patient highlights the importance of proper protective measures in the workplace. Employers should ensure that workers are provided with adequate ventilation and protective equipment to minimize exposure to cotton dust. Frequent follow up and monitoring leads to early detection and management of byssinosis. Timely diagnosis and appropriate management are crucial in preventing the progression of byssinosis to more severe conditions like fibrosis. Treatment options may include medications to reduce inflammation, pulmonary rehabilitation to improve lung function, and in severe cases, lung transplantation. In conclusion, while byssinosis is a rare condition, it is important to recognize the potential for it to lead to serious complications such as fibrosis. Proper protective measures, timely diagnosis, and effective management can help in curing the disease and preventing severe outcomes.

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